ATRF-2060: GREEN ROOFING TECHNOLOGIES

Cuyahoga Community College

Viewing: ATRF-2060 : Green Roofing Technologies

Board of Trustees:
1/30/2025

Academic Term:
Spring 2025

Subject Code
ATRF - Applied Industrial Technology - Roofing

Course Number:
2060

Title:
Green Roofing Technologies

Catalog Description:
Introduction to green roofing technology including cool roofs, insulated roofs, and the related technologies used to modify most traditional roofing systems to improve solar reflectance and thermal emittance.

Credit Hour(s):
2

Lecture Hour(s):
2

Requisites

Prerequisite and Corequisite
Departmental approval: admission to Roofer's Apprenticeship program.

Outcomes

Course Outcome(s):
Discuss various types of green roofing technologies, their benefits, and what makes them 'green'.

Objective(s):
1. Describe what is green technology.
2. Discuss the benefits of green technology.
3. Explain the features, advantages, and disadvantages of a cool roof and what makes it 'green'.
4. Explain the features, advantages, and disadvantages of an insulated roof and what makes it 'green'.
5. Describe what makes a ballasted roof system green.
6. Explain the features, advantages, and disadvantages of a vegetative roofing system and what makes it 'green'.
7. Explain the features, advantages, and disadvantages of a photovoltaic roofing system and what makes it 'green'.
8. Explain the features, advantages and disadvantages of skylight arrays and what makes them 'green'.
9. Discuss what rainwater harvesting is and the advantages and disadvantages of rainwater harvesting.
10. Discuss what is green substitution.
11. Describe what recycling is in built-up roofing.
12. Discuss what is different about green safety.

Course Outcome(s):
Explain the key features of cool roofs, their benefits, and how cool roofs affect roofing jobs.

Objective(s):

1. Describe the features that make a cool roof ‘cool’.
2. Identify codes and green building programs that include cool roofs.
3. Explain how cool roofs affect roofing jobs.
4. Discuss the differenced between black surfaces and white surfaces in relation to solar reflection and thermal emittance.
5. Describe the effectiveness of different colors available in cool roofing.
6. Discuss the impact of different colors for traditional roofing both on energy efficiency and the life of the roof.
7. Discuss the pros and cons of a cool roof.

Course Outcome(s):

Explain green roofing practices for installing an insulated roof.

Objective(s):

1. Describe the types and purposes of insulation.
2. Explain R-value.
3. Explain what makes an insulated roof ‘green’.
4. Identify five installation practices for insulated ‘green’ roofs.

Course Outcome(s):

Discuss the various types, safety hazards, and installation steps for photovoltaic (PV) roofing systems.

Objective(s):

1. Describe the types of photovoltaics (PV) in roofing.
2. Detail safety hazards for PV.
3. Explain the installation steps for the types of PV in roofing.

Course Outcome(s):

Discuss the various types of skylights, their safety hazards, and the issues they can create for roofing.

Objective(s):

1. Explain how skylight arrays are ‘green’.
2. Name the number one hazard of skylights.
3. List type types of skylights.
4. Describe issues that skylights can create.

Course Outcome(s):

Discuss rainwater harvesting systems, including their uses, components, steps involved, and unique hazards, and explain how these systems contribute to sustainability.

Objective(s):

1. Describe rainwater harvesting and its uses.
2. List the four steps in a rainwater harvesting system.
3. Explain what makes rainwater harvesting ‘green’.
4. Describe the rainwater harvesting work of roofers.
5. List the best and worst roof types for rainwater harvesting.
6. List the parts of a rainwater harvesting conveyance system.
7. List the three categories of filters (defined by their locations).
8. List the main purposes of pre-tank filtration.
9. Name two primary ‘first flush’ pre-tank filtration devices.
10. Name at least four other types of specialized pre-tank filters.
11. List two main types of storage tanks.
12. Describe the distribution process.

13. List the old traditional hazards present in ‘green’ roofing.
14. Name two or more unique hazards of ‘green technologies.

Methods of Evaluation:

1.Quizzes from Roofer’s International Training Resource Center
2.Exams from Roofer’s International Training Resource Center
3.Hands on projects
4.Participation

Course Content Outline:

1. Introduction to Green Technology
    a. Definition
    b. Sustainability
    c. Benefits
    d. LEED Certification
    e. Green Roofing technologies systems
    f. Cool Roofs
        i. Solar Reflectance
        ii. Thermal Emittance
        iii. Cool Roofs Rating Council (CRRC)
        iv. Benefits
            1. Increased occupant comfort
            2. Reduced AC use and energy savings of 10% to 30%
            3. Decreased roof maintenance due to longer roof life
    g. Insulated Roofs
        i. Have long been Common in northern areas with colder winters
        ii. Newer use in Southern/warmer climates.
    h. Ballasted Systems
        i. Advantages
        ii. Disadvantages
    i. Vegetative systems
        i. Benefits
        ii. Types
            1. Intensive
            2. Semi-intensive
            3. Extensive
        iii. Waterproofing membrane
        iv. Drain layer
        v. Growing medium
        vi. Plant layer
        vii. Maintenance
    j. Photovoltaics (PV)
        i. Types
            1. PV laminate membranes
            2. PV panels
            3. PV tiles
            4. PV shingles
        ii. Safety
        iii. Electrical hazard
    k. Skylight Arrays
        i. Advantages
        ii. Disadvantages
    l. Rainwater Harvesting
        i. Advantages
        ii. Disadvantages
    m. Green material substitutions

        i. Synthetic roofing shingles
        ii. Recycled rubber
        iii. Recycled metal
        iv. Pavers
    n. Recycling
    o. Green Safety
2. Cool Roofing
    a. Features
        i. Solar reflectance Index
        ii. Thermal emittance
        iii. Color variation
            1. Cool roofing
            2. Traditional roofing
        iv. Pros and cons
            1. Direct benefits
            2. Potential problems
        v. Heat Island Effect
        vi. Cool Roofs and Air Pollution
        vii. Cool Roofs and Jobs
3. Insulated Roofs
    a. Types and purposes of insulation
    b. R-values
    c. What makes an insulated roof green?
    d. International Energy Conservation Code (IECC)
    e. Selection factors for insulation of a green roof
        i. Cost
        ii. Energy code requirements
        iii. Ease of installation
        iv. Compatibility
        v. Weight
        vi. Drainage
        vii. Strength
        viii. Dimensionality
    f. Compatibility with roof covering
    g. Equivalent thermal resistance
    h. Practices to install insulated ‘green’ roofs
        i. Use two insulation layers or more
        ii. Avoid thermal bridges
        iii. Trim to fit, leave no gaps, and stagger joints
        iv. Prior to installation, store rigid insulation
        v. Protect installed rigid insulation from damage
4. Photovoltaics
    a. Types of photovoltaics
    b. Electrical components of all PV systems
    c. Basics of PV electricity generation
    d. Basic types of PV cells
    e. Series or parallel wiring
    f. Safety hazards for Photovoltaics
    g. Installation Steps for PV types in Roofing
5. Skylight Arrays
    a. What makes skylight arrays ‘green’
    b. Number one skylight hazard
    c. Types of skylights
        i. Flat skylights
        ii. Domed skylights
        iii. Parabolic skylights
        iv. Vaulted skylights
        v. Ridge skylights

vi. Smoke vents
vii. Tubular skylights, solar tubes, and sun tunnels
viii. Custom geometry skylights
ix. Modified configurations

d. Skylight Issues
i. Glazing
ii. Leaks
iii. Curbs
iv. Insulation issues
v. Air/vapor barrier issues

6. Rainwater Harvesting
a. What is it?
b. How is it harvested rainwater used?
i. Vehicle washing
ii. Facility cleaning
iii. Fire suppression
iv. Industrial processing
v. HVAC cooling towers
vi. Landscape irrigation
vii. Household cleaning
viii. Laundry washing
ix. Toilet flushing
x. Agriculture

c. Steps in rainwater harvesting system
i. Collection
ii. Conveyance
iii. Storage
iv. Distribution

d. What makes rainwater harvesting 'green'
i. Aids water conservation
ii. Reduces stormwater runoff

e. Roofer's rainwater harvesting work
f. Rainwater harvesting Step 1; Collection
i. Best roofs for collection (less pollution)
1. Cool roofs
2. Concrete tile
3. Metal (no copper or roofs with lead flashing)

ii. Good
1. Slate
2. Membrane

iii. Less desirable roofs for collection
1. Vegetative
2. Terra Cotta tile

g. Rainwater harvesting Step 2: Conveyance
i. Roof slopes
ii. Gutter systems
iii. Gutter slope
iv. Gutter shape
v. Drains and downspouts

h. Categories of Filtration
i. Pre-tank
ii. In-tank
iii. Post-tank

i. Purposes of filtration
j. Primary stage 1 Pre-tank filtration devices
k. Rainwater harvesting step 3: Storage
l. Rainwater Harvesting Step 4: Distribution

7. Green Safety

a. Traditional Hazards
b. Unique Hazards of Green Technologies
    i. Cool Roofs
        1. Reflected energy
        2. Snow blindness
        3. Possible increased skin cancer risk
        4. Fall hazards on slippery smooth surfaces
    ii. Insulated Roofs
        1. Height/fall hazard
        2. Slip, trip, and fall hazards
        3. Wind hazards
        4. Irritation of eyes, nose, and throat during cutting
        5. Isocyanate exposure
    iii. Photovoltaics
        1. Slippery surfaces
        2. Electrical hazards
        3. PV panel hazards
    iv. Skylight Arrays
        1. Serious fall risk
        2. Cut risk
    v. Rainwater Harvesting
        1. Fall
        2. Hit by objects
        3. Slip and trip
        4. Heat and cold
        5. UV exposure
        6. Hazardous substances

Resources

Green Roofing and Waterproofing Technologies Instructor Guide. United Union of Roofers, Waterproofers, & Allied Workers, 2020.

Resources Other

Annual Instructor Training, Washtenaw Community College, Ann Arbor, MI. 2024.

Roofer's Training Resource Center. Rooferstrc.com (http://catalog.tri-c.edu/courseadmin/5293/Rooferstrc.com). 2024.

Planning-Teaching and Assessing Effective Lesson Plans Video for Trades Instructors. United Union of Roofers, Waterproofers, and Allied Workers National Apprenticeship Program, 2023

Computers for the Trade Teacher Video. United Union of Roofers, Waterproofers, and Allied Workers National Apprenticeship Program, 2023

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